FINAL
Evaluation Report

Review of Remedial Investigation at Calverton Naval Weapons Industrial Reserve Plant, Calverton, New York

Installation Restoration Sites
6A - Fuel Calibration Area, 10B - Engine Test Area,
and
Off-site Southern Area

Prepared for
Restoration Advisory Board
Calverton Naval Weapons Industrial Reserve Plant

Prepared by
SCA Associates

August 9, 2003

SCA
ASSOCIATES

Table of Contents

1.0 Executive Summary

SCA Associates was asked to review the Navy's investigation of ground water contamination associated with former jet-engine testing operations at the plant. The purpose of the review was to help the RAB community members understand the results of the investigation and conclusions about the nature and extent of contamination, and to identify any short-coming, errors or additional actions that should be considered before moving forward with remediation.

At Sites 6A, aircraft fuel delivery systems were pressurized with fuel and tested for leaks at two concrete pads and on the adjacent concrete apron. At site 10B, an engine test house was located about 1,000 feet southeast of the fuel calibration pad area. Jet engines were operated in this building before being installed in aircraft. The Southern Area is located southeast of 10B and extends beyond the NWIRP site boundary south of Swan Pond Road/River Road. The area is mostly wooded, and two small ponds (referred to as the runway ponds) lie near the southern boundary of the plant site north of the road. Ground water flows from the site in a southeasterly direction from sites 6A/10B beneath the road through the Southern Area and discharges into the Peconic River about 1.2 miles away and/or into Flander's Bay.

Leaks and spills of jet fuel and spills and/or disposal of solvents used at the fuel calibration area and engine test house in the mid-1970s to 1980 contaminated the ground water beneath these sites, at down-gradient areas on the Calverton NWIRP property, and at off-site locations in the Southern Area. Free-phase petroleum product and contaminated ground water were recovered at 6A/10B from 1987 to 1993. Chlorinated volatile organic compounds (VOCs) and petroleum hydrocarbon VOCs are present in ground water in the Site 6A/10B area; chlorinated VOCs are present at down-gradient locations in the Southern Area up to one mile from the site.

In SCA Associates' opinion, some uncertainties remain about the nature and extent of ground water contamination at 6A/10B and the Southern Area. Deep ground water contamination could be more extensive than thought; significant migration could result, especially if preferential pathways of higher permeability exist. The lack of data from deep strata in locations between the source area and down-gradient impact locations leaves open the possibility that other areas of highly-contaminated ground water are present. Conditions could be different than assumed; it has been three to six years since ground water samples were collected, and most data represent only a single sample event for each test well/boring.

SCA Associates offers the following suggestions, therefore, for the Navy to consider as it plans and implements a Feasibility Study of potential remedial alternatives.

- Additional information on potential contaminant transport in deep strata could be obtained in "pre-design" data acquisition work typically conducted to refine evaluations of conceptual remedies and to define requirements for detailed

designs of the preferred alternative(s). Two sets of test borings, one located near the on-site source areas, and the other at or near the down-gradient site boundary, could resolve uncertainty about the extent of deep ground water contamination.

- Since there were only two ground water sampling events (1997 and 2000), and most of the test wells/borings were sampled in only one of those events, it would be prudent to establish key ground water monitoring points and sample them all to confirm that conditions match the existing data and investigators' assumptions.

- One or more test wells/borings located near the Peconic River (near borings SA-PZ-102D, Sa-PZ-103D, or SA-TW-113) advanced into the deep water bearing sand (about 200 feet bgs) would resolve uncertainties about ground water flow and contaminant fate and transport in the deep zone.

2.0 Introduction

The Engineering Field Activity Northeast of the Naval Facilities Engineering Command retained SCA Associates in September 2002 to provide Technical Assistance to its Restoration Advisory Board (RAB) for the closed Calverton Naval Weapons Industrial Reserve Plant (NWIRP) in Calverton, New York. SCA Associates was asked to review the Navy's investigation of ground water contamination associated with former jet-engine testing operations at the plant. The purpose of the review was to help the RAB community members understand the results of the investigation and conclusions about the nature and extent of contamination, and to identify any short-coming, errors or additional actions that should be considered before moving forward with remediation.

Frank S. Anastasi, PG, SCA Associates Principal, reviewed the Final Phase 2 Remedial Investigation (RI) Report, dated July 2001; the Technical Site Data Report, dated September 7, 1999; and relevant portions of the previous RCRA Facility Investigation/Assessment reports published from March 1995 to January 1997 that relate to this matter. Mr. Anastasi also performed a site visit on October 3, 2002 to observe current site conditions and interview the Navy Project Manager and contractor personnel who are familiar with details of the site investigation. Additionally, he visited the site again to meet with RAB community members and attend the RAB meeting on January 9, 2003.

3.0 Summary of the Site History and Conditions

Sites 6A/10B - Fuel Calibration Area and Engine Test House

Aircraft fuel delivery systems were pressurized with fuel and tested for leaks at two concrete pads as well as on the adjacent concrete apron. An old pad was located in what is now the grassy field; the new pad is located north and east of the old pad on the concrete apron. A shed and piping for fuel delivery were also located at this site, but they are no longer present. The engine test house is located about 1,000 feet southeast of the fuel calibration pad area. Jet engines were operated in this building before being installed in aircraft. Figure 1 shows the features of the site.

A former septic-system leach field and the current wastewater treatment plant are located in the 10-acre open field that lies south of the fuel calibration area. Storm water runoff from the concrete pad/apron flows onto the field, collects in two swales, then enters a buried culvert that extends about 625 feet southward before discharging into a drainage ditch. The ditch leads to a shallow pond located about 1500 feet south-southeast of the fuel calibration pad area.

The sources of contamination at these sites are leaks and spills of jet fuel and spills and/or disposal of solvents used at the fuel calibration area and engine test house in the mid-1970s to 1980. The RI raised the possibility that a leaking underground storage tank may have contributed to the contamination at the engine test house, but no details are provided. The RI report states that records indicate that as much as 230 gallons of fuel were spilled at the calibration area. Petroleum contamination in this area was addressed as early as 1984.

Beginning in 1987, free-phase petroleum product and contaminated ground water were recovered from beneath the grassy field. The fluids pumped from the wells were directed to an oil/water separator tank. The petroleum was collected from the tank and disposed at an off-site facility; the water from the tank was piped into the buried culvert. This system was shut down in 1993, after recovering approximately 1200 gallons of petroleum. Reportedly, petroleum continued to be recovered from the wells, probably by occasionally bailing the wells by hand, until 1997.

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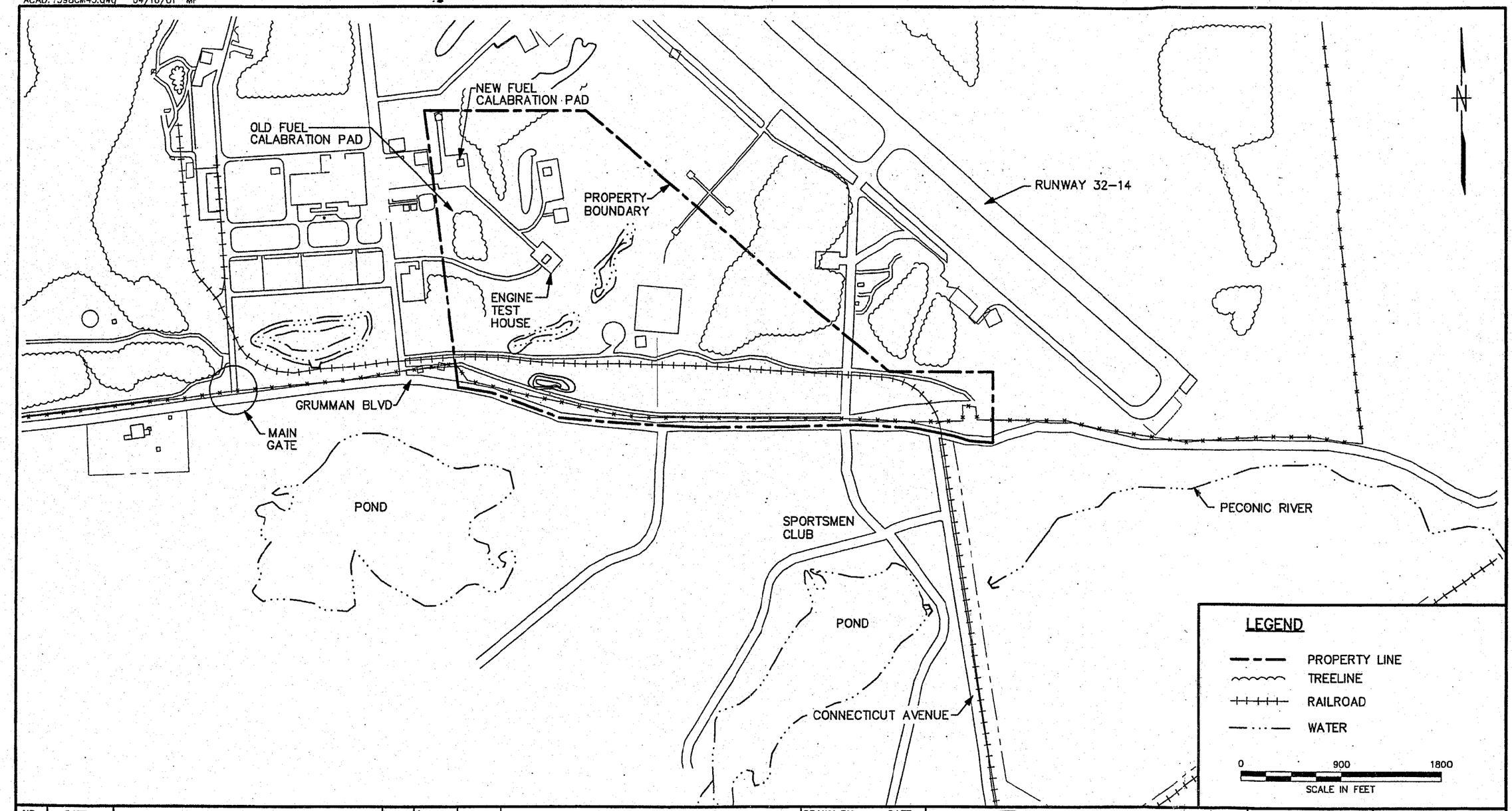

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY HJP DATE 1/3/01
CHECKED BY DATE
COST/SCHED–AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

STUDY AREA
SITES 6A AND10B, AND SOUTHERN AREA
PHASE 2 – REMEDIAL INVESTIGATION
NWIRP, CALVERTON, NY

CONTRACT NO. 7398 | OWNER NO. 0270
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 2–1 | REV. 0

FORM CADD NO. TtNUS_BH.DGN - REV 0 - 1/20/98

Figure 1. Features of the Site and Study Area

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Chlorinated volatile organic compounds (VOCs) originating from the solvents used at the site, as well as petroleum hydrocarbon VOCs, are present in ground water in the Site 6A/10B area. The highest concentrations of the primary contaminants were found at/in the vicinity of monitor well FC-MW-02-S. The following table summarizes the VOCs that exceeded state drinking water standards (generally 5 ppb unless otherwise noted) and their maximum concentrations at the Fuel Calibration Area and Engine Test House Area.

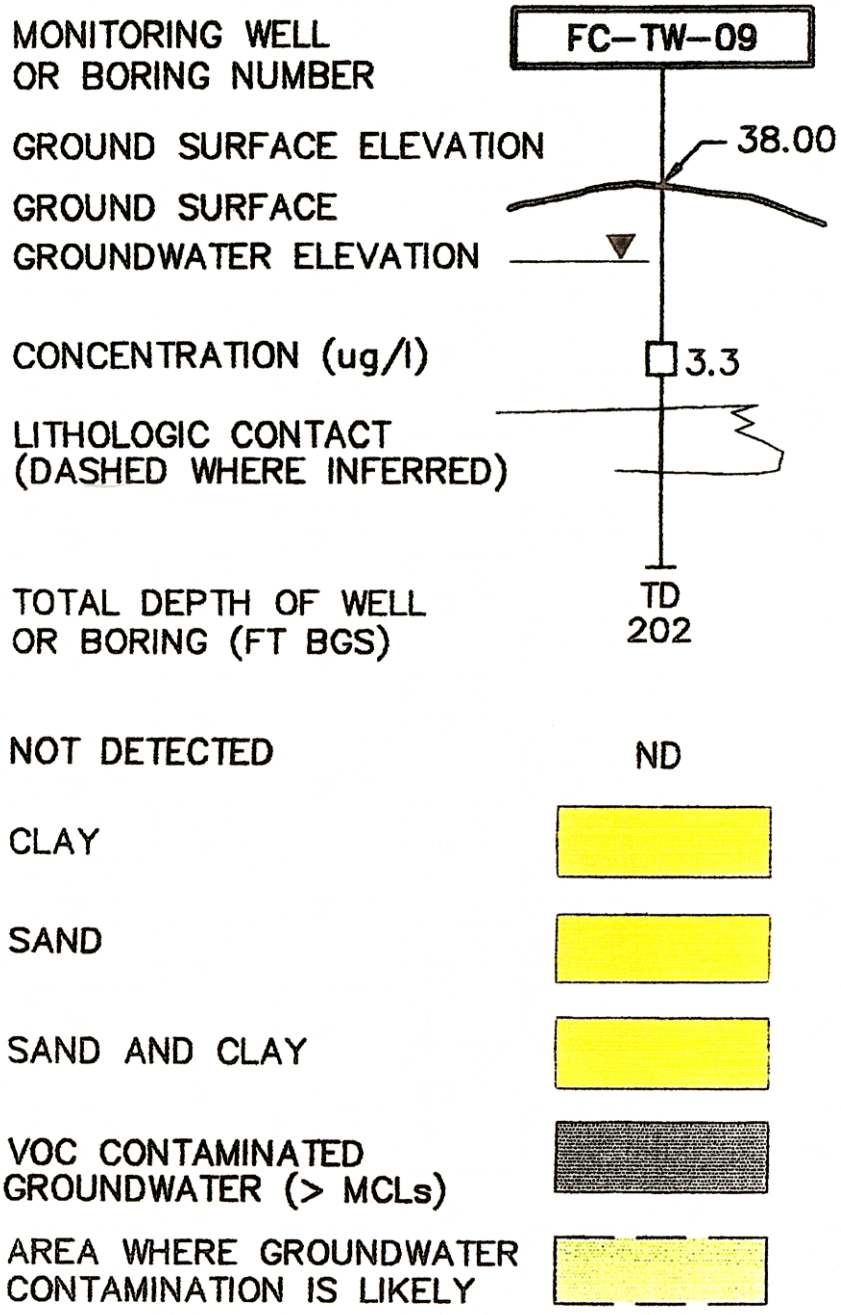
Table 1. Summary of Maximum Concentrations of Primary Contaminants Detected in On-Site Areas

Contaminant	State Standard (ug/L)	Concentration at Fuel Calibration Area (ug/L)	Concentration at Engine Test House Area (ug/L)
1,1,1-TCA	5	2200	166
1,1-DCA	5	3600	53
1,1-DCE	5	37	188
Chloroethane	5	720	138
TCE	5	6	--
Benzene	0.7	44	--
Ethylbenzene	5	81	1084
Toluene	5	180	337
Xylene	5	570	196
Vinyl Chloride	2	--	27

At many of the sampling locations, discreet samples were collected from different depths below ground surface (bgs) as the test boring was advanced to characterize the profile of contaminant concentrations with depth. Significant concentrations (i.e., greater than state standards) of chlorinated VOCs were found in ground water to depths up to 200 feet beneath the fuel calibration area. Figure 2 is a copy of a portion of a figure from the RI report that shows the observed distribution of VOCs with depth in the on-site areas.

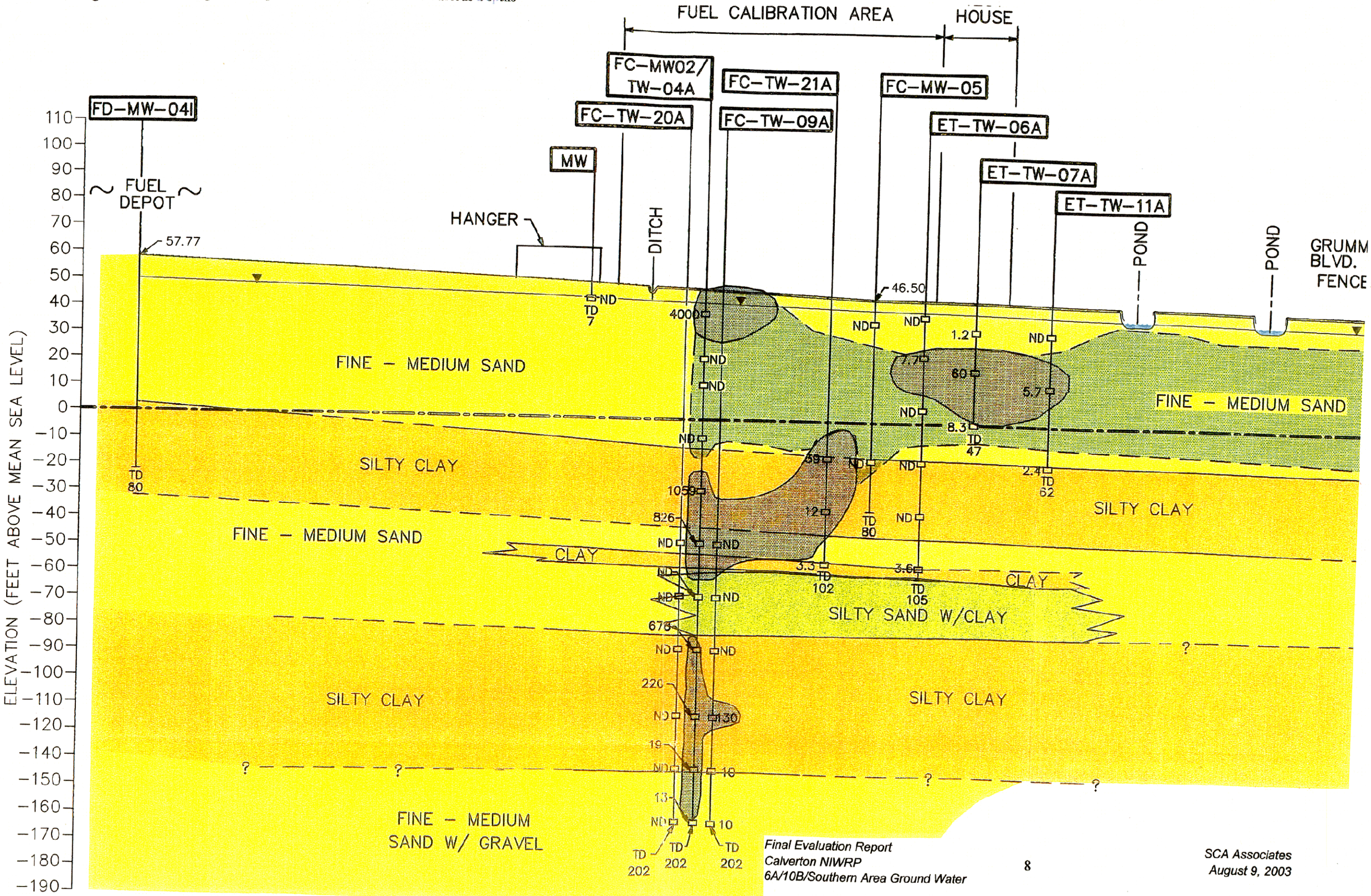
Off-site Southern Area

The Southern Area is located southeast of the Engine Test House and extends beyond the NWIRP site boundary south of Swan Pond Road/River Road (hereafter referred to as 'the road'). The area is mostly wooded, and two small ponds (referred to as the runway ponds) lie near the southern boundary of the plant site north of the road. Runoff that travels through the drainage swales, buried culvert and drainage ditch at the fuel calibration pads and engine test house areas discharges into these ponds. Ground water flows from the site in a southeasterly direction from the calibration pads and engine test house area beneath the road through the Southern Area and discharges into the Peconic River about 1.2 miles away and/or into Flander's Bay.



Legend for Figures 2 and 3 (Cross Sections Showing Contamination at Various Depths)

Figure 2. Volatile Organic Compounds in Ground Water at Various Depths



Ground water contamination was observed in a Suffolk County monitoring well located along the road south of the plant property in the 1980s. Although no potential contaminant source was apparent in this area, 1,1,1-TCA and associated chlorinated VOCs were confirmed in the county monitoring well and subsequently in wells installed further down-gradient as part of the RI. The RI concluded that the source of the VOCs in the southern area was infiltration of the contaminated ground water that had been recovered from the fuel calibration area as it flowed through the swales, culvert and ditch and seeped from the two shallow ponds.

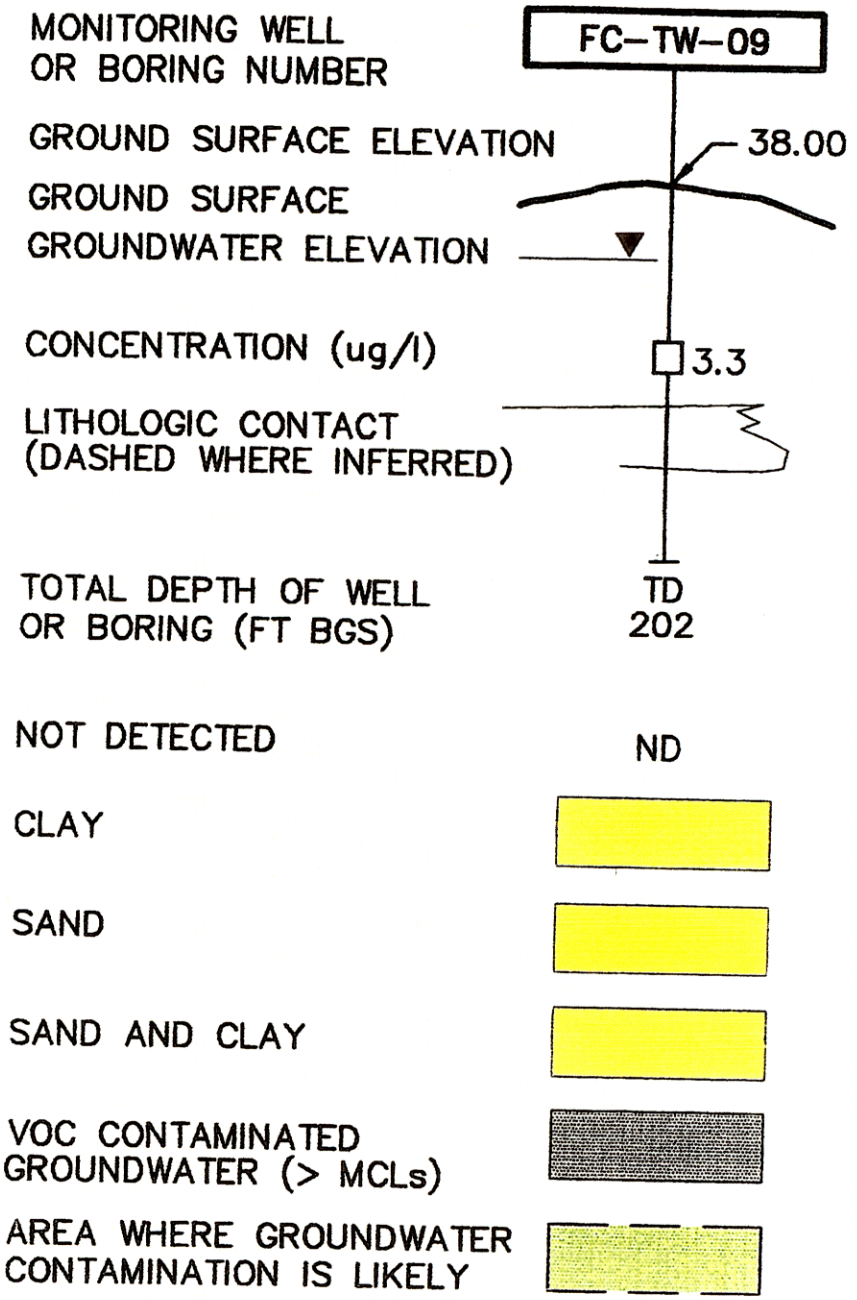
Based on available information, including the most recent ground water sampling conducted in August 2000, elevated levels of chlorinated VOCs are present in the Southern Area ground water as far as about one mile southeast of the fuel calibration area on property owned by a private sportsmen club. Three test borings/monitoring wells (designated SA-TW-111, SA-TW-112, and SA-TW-113) installed on this property in 2000 by the Navy contained one or more chlorinated VOCs at levels that exceeded the state drinking water standards. The deepest discrete sample from the test boring located farthest from the fuel calibration area (collected at 95 feet bgs in SA-TW-113), which appears to be directly down-gradient from the source areas, contained 1,1,1-TCA, 1,1-DCA and 1,1-DCE at 18, 130, and 9 ppb, respectively. Samples collected at 60 and 75 feet bgs also contained these VOCs. Reportedly, a supply well that previously served the sportsmen club has been closed due to the presence of VOCs above state standards.

Maximum concentrations of contaminants that exceeded state drinking water standards in the Southern Area as reported in the RI are shown in the following table.

Table 2. Summary of Maximum Concentrations of Primary Contaminants Detected in Off-site Southern Area

Contaminant	State Standard (ug/L)	Concentration at Southern Area (ug/L)
1,1,1-TCA	5	94
1,1-DCA	5	220
1,1-DCE	5	21
1,2-DCE	5	13
vinyl chloride	2	2
xylene	5	18

Figure 3 is a copy of a portion of a figure from the RI report that shows the observed distribution of VOCs with depth in the off-site Southern Area. Figure 4 shows the known and suspected extent of the ground water contamination at the site and extending into the Southern Area as depicted in the RI report. Appendix A contains the ground water monitoring data reported in the RI that document the nature and extent of the contamination.



Legend for Figures 2 and 3 (Cross Sections Showing Contamination at Various Depths)

Figure 3. Volatile Organic Compounds in Ground Water at Various Depths

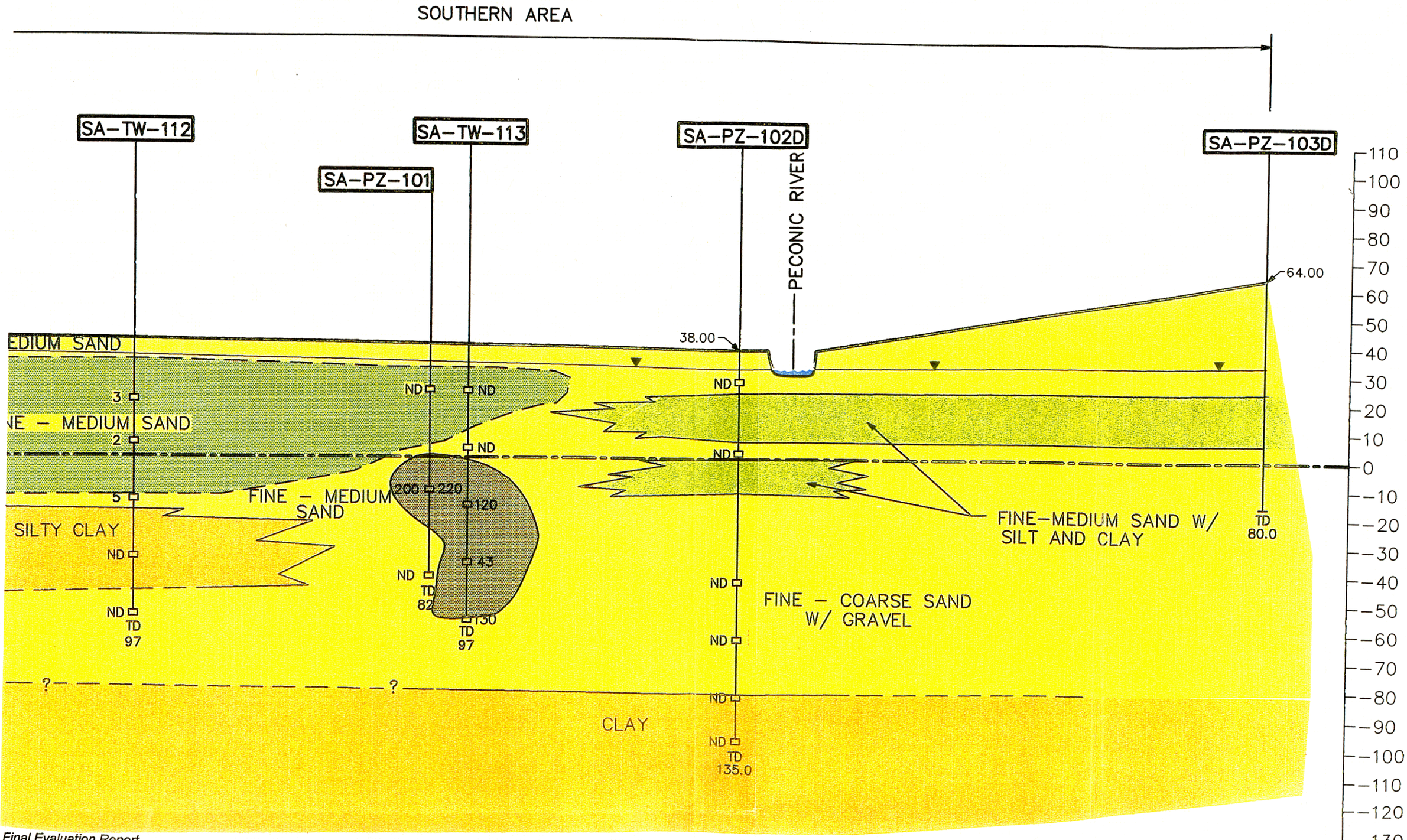


Figure 4. Extent of Ground Water Contamination at the Site and Study Area

4.0 Summary of Conclusions of the Remedial Investigation

The RI concluded that the nature and extent of the ground water contamination in the study area has been defined adequately for the purposes of proceeding to analysis of potential remedial alternatives. The major conclusions can be summarized as follows.

Chlorinated VOCs in ground water is the primary site concern.

- The on-site plume extends about 1500 feet south-southeast from the fuel calibration test area as a result of VOCs migrating with ground water at about 80 feet per year.

- The source area for the on-site contamination at the fuel calibration area and engine test house is located near the old calibration pad, where leaks and spills were reported and the highest contamination was found.

- The majority of the contaminant mass is present within the top 40 feet of the soils beneath the source area. The area of deepest ground water contamination on-site (up to about 200 feet bgs) is located in the northern part of the fuel calibration area.

- Free-phase petroleum is present and both petroleum-hydrocarbon and chlorinated-solvent VOCs exceed state standards in those areas.

- Leaks and spills during operations, as well as infiltration of contaminated ground water that was recovered and then discharged into the on-site drainage structures from 1987 – 1993, probably contributed to the contamination near the engine test house.

A continuous plume of contamination does not appear to extend from the on-site areas to the off-site Southern Area

- Ground water contamination in the Southern Area appears to be the result of seepage of contaminated water from the drainage ways and runway ponds, with subsequent flow down-gradient to the southeast beyond the plant site boundary.

- Significant impacts (i.e., VOCs exceeding state standards) have been found as far as about 3500 feet down-gradient from the runway ponds.

Sampling, modeling and analyses indicate that contaminated ground water is or will be discharged into the Peconic River about 1.2 miles down-gradient from the on-site source area(s).

- The highest concentration of a VOC in groundwater discharging into the river would be 65 ppb (for 1,1-DCA).

- With a dilution factor of 25, the maximum concentration of 1,1-DCA in the river water at the ground water discharge point would be 2.6 ppb (less than drinking water and surface water quality standards).

- The RI acknowledged that other VOCs would also be discharged into the river, but they would be at lower concentrations.

The human-health risk assessment determined that soils and groundwater at the on-site fuel calibration area present unacceptable risks only under a hypothetical, future residential land-use scenario. Risks to current site maintenance workers are acceptable.

- Groundwater ingestion contributed the most significant portion of risk, primarily due to the chlorinated-solvent VOCs.

- The next most significant contribution to risk was from a petroleum hydrocarbon compound (benzo(a)pyrene) in soil.

An ecological risk assessment was not performed because the RI concluded that there was a lack of sensitive receptors potentially exposed to contamination at the site.

Ground water fate and transport modeling concluded that about 90 percent of the mass of chlorinated VOCs and 60 percent of the mass of the petroleum VOCs would be degraded within about 20 years of introduction into the subsurface

- Estimated initial release dates are 1978-1980 for solvents; 1975 for fuel.

- Based on the modeling, none of the contaminant mass migrating directly in the ground water from the on-site areas would ever reach the Peconic River.

- Contaminants migrating in the ground water from the area of the drainage ditch and/or runway ponds, however, could reach the Peconic River.

5.0 SCA Associates' Evaluation and Comments on the RI

Based on review of the available information, the RI approach, methods, analyses and interpretations are generally acceptable and reasonable. The ground water data collected from more than 40 wells/test borings support the interpretation that conditions are as depicted in the RI report. SCA Associates has reached the following conclusions as a result of our evaluation of the RI.

Nature and Extent of Contamination

In our opinion, these data are sufficient to confirm that the nature and extent of ground water contamination is understood fairly well.

- A relatively small, relatively stable area of petroleum contamination (free product and dissolved petroleum constituents) exists on-site. Biodegradation and natural attenuation appear to be limiting the extent of this contamination to the vicinity of the source areas. This is typical for petroleum spill sites.

- A larger area of chlorinated VOC contamination exists both on-site and off-site more than one mile down-gradient from the source area(s). This contamination has migrated significantly. Although degradation and natural attenuation processes may be reducing the severity of this contamination somewhat, observed concentrations still exceed state drinking water standards at the leading edge of the plume in the off-site Southern Area. Modeling predicts that significant contamination would still exist 130 years from now under current conditions. This is typical for chlorinated solvent spill sites.

There are some uncertainties, however, that have potentially significant implications for the selection of an effective remedial strategy to mitigate the ground water contamination, especially for off-site areas. How the chlorinated VOCs migrated to their farthest down-gradient locations in the Southern Area is somewhat uncertain, as is the extent of VOCs in deep water bearing strata (150 to 200 feet or more).

- The contaminants could have reached the Southern Area due to actual transport in the ground water as it flowed from the on-site source areas at the fuel calibration test areas toward discharge points at the Peconic River (and potentially beyond).

- Multiple releases may have occurred over the history of plant operations, in which case the VOCs could have been migrating as relatively discrete "slugs" of contaminated ground water, as opposed to a single plume from a single release.

- Their presence at the distant locations could be (as the RI suggests) due to infiltration of contaminated ground water that had been pumped from the source areas in 1987-1993 after it was discharged into the on-site drainages and ponds.

- Significant ground water contamination (i.e., VOCs exceeding state standards) is documented on-site in test boring/monitor well FC-MW-02/TW-04A to a depth of about 200 feet bgs. The down-gradient extent of this contamination is not known, since no other samples were obtained from the corresponding depth/geologic strata at down-gradient locations.

The potential implication of deep ground water contamination is that significant migration could be occurring in deep strata without the investigators' knowledge. Leakage of VOCs from the shallow water-bearing zone into deeper strata could have occurred through discontinuities (e.g., sandy and/or silty zones in clay layers). Once in the deep zone, significant migration could result, especially if preferential pathways of higher permeability exist (such as the gravel noted in the fine/medium sand strata observed at the bottom of FC-MW-02/TW-04A). However, the lack of data from deep strata in locations between the source area and the runway ponds, and between the runway ponds and sportsmen club, precludes ruling out the possibility that other areas of highly-contaminated ground water are present. Figures 5,6,7 and 8 illustrate the occurrence of 1,1,1-TCA and 1,1-DCA in deep strata beneath the fuel calibration area and the lack of sampling data in corresponding deep strata at down-gradient locations.

Fate and Transport Analyses/Modeling

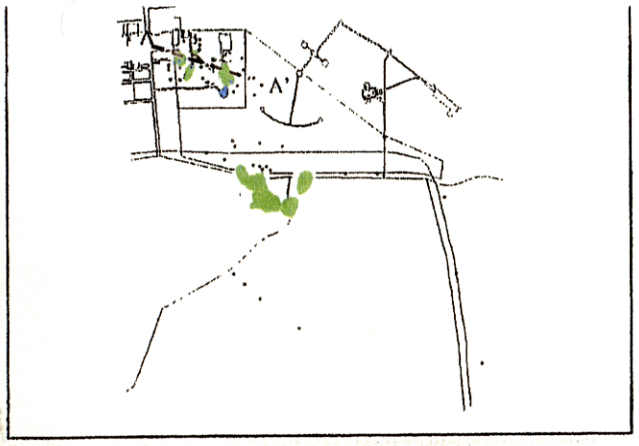
Significant uncertainties should have been acknowledged in the RI discussions of fate and transport modeling (Appendix G). In our opinion, the modeled and assumed contaminant travel-times do not support the theory as strongly as the RI suggests that a continuous plume does not exist from the source area off-site to the Southern Area.

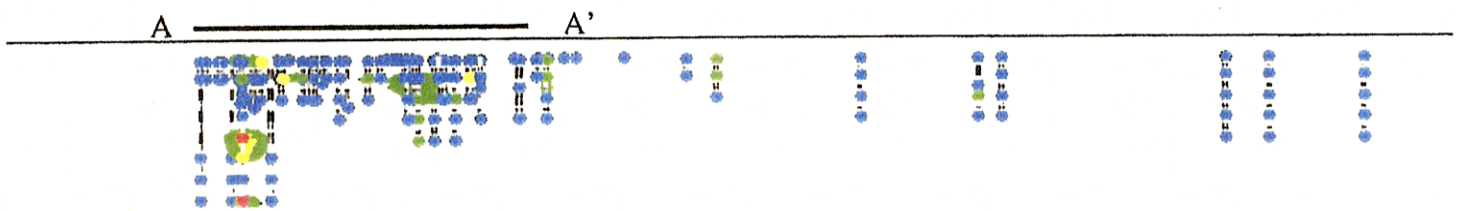
- Calibration and verification of model results with actual field conditions appears rather weak -- this is typical, and not necessarily fatal, but it should be recognized.

- Reasonable variations in model parameter assumptions, such as ground water flow velocity, hydraulic conductivity, contaminant retardation factors, and dates of releases, could result in model output that supported the existence of a continuous plume. [As the RI mentions, the best data are the results of analysis of ground water samples.]

Lack of Recent, Comprehensive Ground Water Data

Conditions could be different than assumed, especially since it has been three years (or in some cases six years) since ground water samples were collected. Furthermore, the vast majority of data represent only a single sample event for each test well/boring (i.e., most wells/borings were sampled on only one date). Contaminant concentrations and their distribution typically change over time. Moreover, the past few years of drought conditions and more recent trend of recovery in ground water levels may have influenced the distribution of contaminants as well as free-phase petroleum.



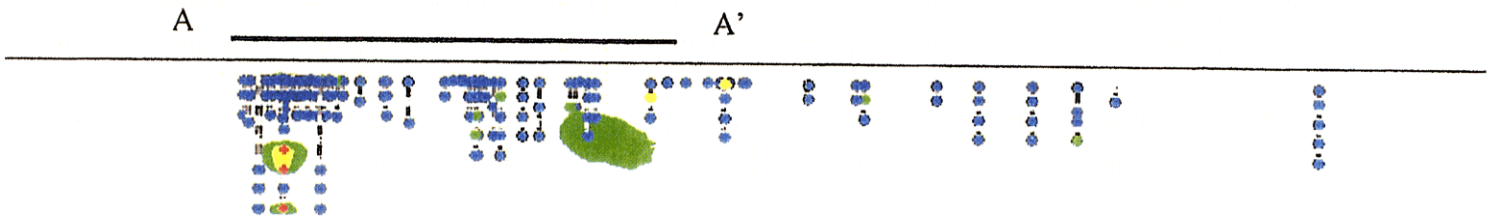


LEGEND
- Non-detect - 5
- 5 - 50
- 50 - 500
- 500 - Maximum

Maximum 1,1,1 - TCA Concentration = 12000 ug/l

1,1,1 - TCA EXCEEDING 5 UG/L
CROSS-SECTION A - A'
SITES 6A & 10B

Figure 5. Modeled Visualization of 1,1,1-TCA Concentrations at Various Depths

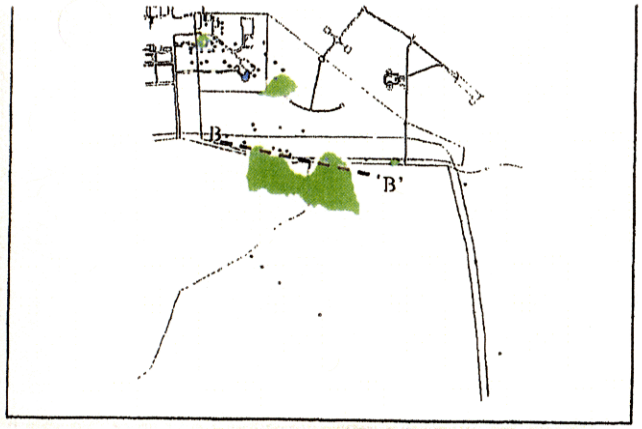


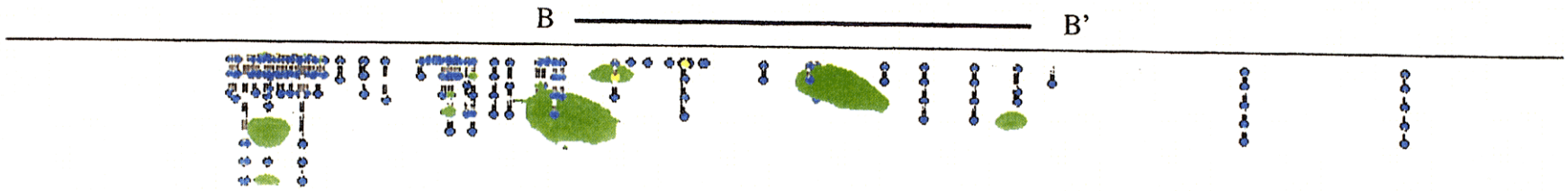
1,1 - DCA EXCEEDING 5 UG/L
CROSS-SECTION A - A'
SITES 6A & 10B

LEGEND
- Non-detect - 5
- 5 - 50
- 50 - 500
- 500 - Maximum

Maximum 1,1 - DCA
Concentration = 4800 ug/l

Figure 6. Modeled Visualization of 1,1-DCA Concentrations at Various Depths



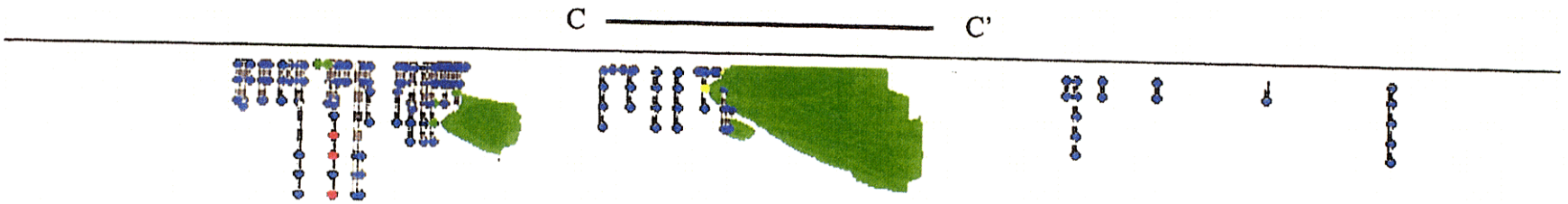


1,1 - DCA EXCEEDING 5 UG/L
CROSS-SECTION B - B'
SITES 6A & 10B

LEGEND
- Non-detect - 5
- 5 - 50
- 50 - 500
- 500 - Maximum

Maximum 1,1 - DCA
Concentration = 4800 ug/l

Figure 7. Modeled Visualization of 1,1-DCA Concentrations at Various Depths



1,1 - DCA EXCEEDING 5 UG/L
CROSS-SECTION C - C'
SITES 6A & 10B

LEGEND
Non-detect - 5
5 - 50
50 - 500
500 - Maximum

Maximum 1,1 - DCA
Concentration = 4800 ug/l

Figure 8. Modeled Visualization of 1,1-DCA Concentrations at Various Depths

6.0 Recommendations to Consider

The uncertainties noted in the previous section do not appear to be significant enough to delay progress on moving to the next step on this project – to evaluate potential remedial alternatives for the on-site and off-site ground water contamination. However, if any of the potentially complicating conditions mentioned in the previous section were actually present, additional remedial alternatives beyond those thought adequate to address the assumed conditions would probably have to be considered.

SCA Associates offers the following suggestions, therefore, for the Navy to consider as it plans and implements a Feasibility Study of potential remedial alternatives.

- Additional information on potential contaminant transport in deep strata could be obtained in "pre-design" data acquisition work typically conducted to refine evaluations of conceptual remedies and to define requirements for detailed designs of the preferred alternative(s). Two sets of test borings, one located near the on-site source areas, and the other at or near the down-gradient site boundary, could resolve uncertainty about the extent of deep ground water contamination.

- Since there were only two ground water sampling events (1997 and 2000), and most of the test wells/borings were sampled in only one of those events, it would be prudent to establish key ground water monitoring points and sample them all to confirm that conditions match the existing data and investigators' assumptions.

- One or more test wells/borings located near the Peconic River (near borings SA-PZ-102D, Sa-PZ-103D, or SA-TW-113) advanced into the deep water bearing sand (about 200 feet bgs) would resolve uncertainties about ground water flow and contaminant fate and transport in the deep zone.

SCA Associates believes that there is no reason not to move forward with a Feasibility Study to begin the process of identifying and evaluating appropriate and effective remedial alternatives. We recommend that as a first step, cleanup requirements should be developed. They should be based on realistic, future-exposure and land-use scenarios for both on-site and off-site areas. Key issues that would need to be addressed include:

- Acceptable concentrations of chlorinated VOCs in ground water at down-gradient, off-site properties where use is not restricted, and at discharge points into the Peconic River.

- The concentrations at these exposure points that would result in unacceptable risks should be considered, and whether they exceed state standards.

- The type of mitigation measures that would be practical.

These are difficult issues, but the Navy, state regulators, and concerned citizens can work together to arrive at a consensus. Then, any remaining critical data gaps can be clearly identified so they can be resolved with focused effort.

Appendix A

Summary of Volatile Organic Compounds Detected in Ground Water Samples Collected in 1997 and in 2000

TABLE 3-1

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 6A - FUEL CALIBRATION AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 1 OF 6

Well ID	FC-TW-01A			FC-TW-02A			FC-TW-03A		
Sample Date	APR '97	APR '97	APR '97	MAR '97	MAR '97	MAR '97	MAR '97	APR '97	APR '97
Depth (ft bgs)	5	20	40	5	20	40	5	20	40
1,1,1-Trichloroethane								14	
1,1-Dichloroethane									
1,1-Dichloroethene									
1,2-Dichloroethene									
Acetone									
Benzene									
Carbon Disulfide									
Chloroethane									
Chloro form									
Ethyl benzene									
Trichlorofluoromethane									
1,1,2-Trichlorotrifluoroethane									
Trichlorofluoroethane									
Methylene Chloride									
Toluene									
Xylene									

TABLE 3-1

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 6A - FUEL CALIBRATION AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 2 OF 6

Well ID	FC-TW-04A										
Sample Date	JUN '97	JUN '97	JUN '97	JUN '97	APR '97	APR '97	MAY '97	MAY '97	AUG '00	AUG '00	AUG '00
Depth (ft bgs)	30	40	60	80	80	100	120	140	165	180	200
1,1,1-Trichloroethane				599	481	416		678	220	19	13
1,1-Dichloroethane					1057	826		523	72	7	3
1,1-Dichloroethene				570	496	186					
1,2-Dichloroethene											
Acetone									12		
Benzene											
Carbon Disulfide										110	
Chloroethane									16	2	
Chloro form				68							
Ethyl benzene						7.2			3		
Trichlorofluoromethane					122						
1,1,2-Trichlorotrifluoroethane											
Trichlorofluoroethane				95							
Methylene Chloride						34					
Toluene					33	16			4		
Xylene					46	18		29	36	5	

TABLE 3-1

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 6A - FUEL CALIBRATION AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 3 OF 6

Well ID	FC-TW-05A				FC-TW-06A			FC-TW-07A		
Sample Date	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97
Depth (ft bgs)	5	20	20*	40	5	20	40	5	20	40
1,1,1-Trichloroethane			1.8						20	0.6
1,1-Dichloroethane										
1,1-Dichloroethene					1.2		1.4		1.1	1.0
1,2-Dichloroethene			3.0		3.1	3.4				
Acetone										
Benzene	37	44								
Carbon Disulfide										
Chloroethane										
Chloro form										
Ethyl benzene	20	8.0								
Trichlorofluoromethane										
1,1,2-Trichlorotrifluoroethane			1.6			0.8			0.7	
Trichlorofluoroethane										
Methylene Chloride										
Toluene	11	34								
Xylene	133	94								

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TABLE 3-1

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 6A - FUEL CALIBRATION AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 4 OF 6

Well ID	FC-TW-08A			FC-TW-09A					
Sample Date	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	JUL '00	JUL '00	JUL '00
Depth (ft bgs)	100	120	140	100	120	140	160	180	200
1,1,1-Trichloroethane							1		
1,1-Dichloroethane							3		
1,1-Dichloroethene									
1,2-Dichloroethene									
Acetone							24	13	
Benzene									
Carbon Disulfide									
Chloroethane							9	2	1
Chloro form									
Ethyl benzene							16	2	
Trichlorofluoromethane									
1,1,2-Trichlorotrifluoroethane									
Trichlorofluoroethane									
Methylene Chloride									
Toluene			2.3				7		
Xylene							130	10	10

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TABLE 3-1

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 6A - FUEL CALIBRATION AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 5 OF 6

Well ID	FC-TW-10A			FC-TW-11A			FC-TW-12A			FC-TW-13A		
Sample Date	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97
Depth (ft bgs)	100	120	140	5	20	40	5	20	40	5	20	40
1,1,1-Trichloroethane											1.9	1.9
1,1-Dichloroethane												
1,1-Dichloroethene												
1,2-Dichloroethene												
Acetone												
Benzene												
Carbon Disulfide												
Chloroethane												
Chloro form												
Ethyl benzene												
Trichlorofluoromethane												
1,1,2-Trichlorotrifluoroethane												
Trichlorofluoroethane												
Methylene Chloride												
Toluene												
Xylene												

TABLE 3-1

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 6A - FUEL CALIBRATION AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 6 OF 6

Well ID	FC-TW-20A							FC-TW-21A		
Sample Date	AUG '00	AUG '00	AUG '00	AUG '00	AUG '00	AUG '00	AUG '00	JUL '00	JUL '00	JUL '00
Depth (ft bgs)	105	120	140	160	180	200	210	60	80	100
1,1,1-Trichloroethane				1				14	6	1.5
1,1-Dichloroethane				2				39	12	3.3
1,1-Dichloroethene										
1,2-Dichloroethene										
Acetone										
Benzene										
Carbon Disulfide										
Chloroethane								4.5	2	
Chloro form										
Ethyl benzene										
Trichlorofluoromethane										
1,1,2-Trichlorotrifluoroethane										
Trichlorofluoroethane										
Methylene Chloride										
Toluene										
Xylene										

Notes:
* = Duplicate Sample
bgs = below ground surface
Blank = Not detected at the analytical method detection limit
Shaded = Detection exceeds NYSDEC Drinking Water Protection Standards
Concentrations in µg/L
Other VOCs not detected

TABLE 3-2

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 10B - ENGINE TEST HOUSE
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 1 OF 6

Well ID	ET-TW-01A		ET-TW-02A		ET-TW-03A		ET-TW-04A	
Sample Date	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97
Depth (ft bgs)	5	20	5	20	5	20	5	20
1,1,1-Trichloroethane								
1,1-Dichloroethane								
1,1-Dichloroethene								
1,2-Dichloroethene								
Benzene								
Bromodichloromethane								
Bromomethane					353			
Carbon Disulfide								
Chlorobenzene	381							
Chloroethane								
Chloro form				15				
Ethyl benzene		143		55	1084	29		
1,1,2-Trichlorotrifluoroethane								
Trichlorofluoroethane								
Methylene Chloride								
Toluene	156	337	31		277	37		
Vinyl Chloride								
Xylene	39	53			127	196		

TABLE 3-2

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 10B - ENGINE TEST HOUSE
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 2 OF 6

Well ID	ET-TW-05A			ET-TW-06A					
Sample Date	APR '97	APR '97	APR '97	APR '97	APR '97	APR '97	JUL '00	JUL '00	JUL '00
Depth (ft bgs)	5	20	40	5	20	40	60	80	100
1,1,1-Trichloroethane		166	3.7						1.5
1,1-Dichloroethane					7.7				3.6
1,1-Dichloroethene		188	30		2.6				
1,2-Dichloroethene									
Benzene									
Bromodichloromethane	4.1								
Bromomethane									
Carbon Disulfide									
Chlorobenzene									
Chloroethane	138	45							
Chloro form									
Ethyl benzene		8.7							
1,1,2-Trichlorotrifluoroethane									
Trichlorofluoroethane									
Methylene Chloride	7.0								
Toluene		8.6							
Vinyl Chloride									
Xylene									

TABLE 3-2

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 10B - ENGINE TEST HOUSE
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 3 OF 6

Well ID	ET-TW-07A					ET-TW-08A					
Sample Date	APR '97	APR '97	APR '97	JUL '97	JUL '97	APR '97	APR '97	APR '97	JUL '97	JUL '97	JUL '97
Depth (ft bgs)	5	20	40	60	80	5	20	40	60	60*	80
1,1,1-Trichloroethane			8.3				26	25		27	
1,1-Dichloroethane										53	
1,1-Dichloroethene	1.2	2.3					1.1				
1,2-Dichloroethene									3.5		3.6
Benzene		2.0									
Bromodichloromethane											
Bromomethane											
Carbon Disulfide											
Chlorobenzene											
Chloroethane											
Chloro form											
Ethyl benzene				2.2							
1,1,2-Trichlorotrifluoroethane		152	33	2.7	0.6		107	72	1.1	3.6	1.5
Trichlorofluoroethane											
Methylene Chloride											
Toluene										0.9	
Vinyl Chloride		60		11						27	
Xylene				3.0							

TABLE 3-2

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 10B - ENGINE TEST HOUSE
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 4 OF 6

Well ID	ET-TW-09A			ET-TW-10A				ET-TW-11A		
Sample Date	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97
Depth (ft bgs)	5	30	60	5	30	30*	60	5	30	60
1,1,1-Trichloroethane					0.6	6.6			5.7	0.5
1,1-Dichloroethane										2.4
1,1-Dichloroethene										
1,2-Dichloroethene										
Benzene										
Bromodichloromethane										
Bromomethane										
Carbon Disulfide										
Chlorobenzene										
Chloroethane										
Chloro form										
Ethyl benzene										
1,1,2-Trichlorotrifluoroethane										
Trichlorofluoroethane										
Methylene Chloride										
Toluene									0.5	0.7
Vinyl Chloride										
Xylene										

TABLE 3-2

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 10B - ENGINE TEST HOUSE
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 5 OF 6

Well ID	ET-TW-12A			ET-TW-13A		ET-TW-14A	
Sample Date	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97	MAY '97
Depth (ft bgs)	5	20	20*	5	20	5	20
1,1,1-Trichloroethane							
1,1-Dichloroethane							
1,1-Dichloroethene							
1,2-Dichloroethene							
Benzene							
Bromodichloromethane							
Bromomethane							
Carbon Disulfide							
Chlorobenzene							
Chloroethane							
Chloro form							
Ethyl benzene							
1,1,2-Trichlorotrifluoroethane							
Trichlorofluoroethane							
Methylene Chloride							
Toluene							
Vinyl Chloride							
Xylene							

TABLE 3-2

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SITE 10B - ENGINE TEST HOUSE
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 6 OF 6

Well ID	ET-TW-15A						ET-TW-16A			
Sample Date	JUN '97	JUN '97	JUN '97	JUN '97	JUL '97	JUL '97	JUN '97	JUN '97	JUN '97	JUN '97
Depth (ft bgs)	5	20	20*	40	60	80	5	30	30*	60
1,1,1-Trichloroethane				22	24	12			0.9	
1,1-Dichloroethane			4.7	49	43			5.4	6.4	13
1,1-Dichloroethene					4.6	4.6				
1,2-Dichloroethene						20				
Benzene					1.4					
Bromodichloromethane										
Bromomethane										
Carbon Disulfide										
Chlorobenzene										
Chloroethane										
Chloro form										
Ethyl benzene					1.7					
1,1,2-Trichlorotrifluoroethane					4.0	2.1				
Trichlorofluoroethane				0.8						
Methylene Chloride										
Toluene										
Vinyl Chloride										
Xylene					1.2					

Notes:
Blank = Not detected at the analytical method detection limit
* = Duplicate Sample
Shaded = Detection exceeds NYSDEC Drinking Water Protection Standards
bgs = below ground surface
Concentrations in µg/L
Other VOCs not detected

TABLE 3-3

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SOUTHERN AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 1 OF 6

Well ID	SA-TW-101			SA-TW-102			SA-TW-103				
Sample Date	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97	JUN '97
Depth (ft bgs)	5	20	60	5	20	40	5	20	20*	40	60
1,1,1-Trichloroethane	11	15	1.1					2.2	0.7	2.1	0.7
1,1,2-Trichloroethane	0.6	1.2	1.9								
1,1-Dichloroethane	4.2	31	4.3								
1,1-Dichloroethene											
1,2-Dichloroethane											
1,2-Dichloroethene											
Acetone											
Carbon Disulfide											
Chloroethane											
Chloro form	1.0	4.7									
Ethyl benzene				2.9							
Trichlorofluoromethane		2.6									
Toluene				1.0							
Vinyl Chloride											
Xylene				18							

TABLE 3-3

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SOUTHERN AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 2 OF 6

Well ID	SA-TW-104				SA-TW-105			
Sample Date	JUL '97	JUL '97	JUL '97	JUL '97	JUL '97	JUL '97	JUL '97	JUL '97
Depth (ft bgs)	5	20	40	60	5	20	40	60
1,1,1-Trichloroethane								
1,1,2-Trichloroethane								
1,1-Dichloroethane		2.1	2.9	1.4		3.9		
1,1-Dichloroethene								
1,2-Dichloroethane								
1,2-Dichloroethene		2.5	0.9	0.9	0.6		0.6	1.0
Acetone								
Carbon Disulfide								
Chloroethane								
Chloro form								
Ethyl benzene								
Trichlorofluoromethane								
Toluene								
Vinyl Chloride				0.4	1.7			
Xylene								

TABLE 3-3

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SOUTHERN AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK

Well ID	SA-TW-106					SA-TW-107			
Sample Date	AUG '97	AUG '97	AUG '97	AUG '97	AUG '97	JUL '97	JUL '97	JUL '97	JUL '97
Depth (ft bgs)	5	20	20*	40	60	5	20	40	60
1,1,1-Trichloroethane				12					
1,1,2-Trichloroethane									
1,1-Dichloroethane				3.1	7.3				
1,1-Dichloroethene					1.2				
1,2-Dichloroethane									
1,2-Dichloroethene									
Acetone									
Carbon Disulfide									
Chloroethane									
Chloro form									
Ethyl benzene									
Trichlorofluoromethane									
Toluene									
Vinyl Chloride									
Xylene									

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TABLE 3-3

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SOUTHERN AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 4 OF 6

Well ID	SA-TW-108					SA-TW-109				
Sample Date	NOV 97'	NOV 97'	NOV 97'	NOV 97'	NOV 97'	NOV 97'	NOV 97'	NOV 97'	NOV 97'	NOV 97'
Depth (ft bgs)	5	20	40	60	80	5	20	40	60	80
1,1,1-Trichloroethane										
1,1,2-Trichloroethane										
1,1-Dichloroethane										
1,1-Dichloroethene										
1,2-Dichloroethane			1.3	1.6						
1,2-Dichloroethene										
Acetone										
Carbon Disulfide										
Chloroethane										
Chloro form										
Ethyl benzene										
Trichlorofluoromethane										
Toluene										
Vinyl Chloride										
Xylene										

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TABLE 3-3

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SOUTHERN AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 5 OF 6

Well ID	SA-TW-110					SA-TW-111					
Sample Date	NOV 97'	NOV 97'	NOV 97'	NOV 97'	NOV 97'	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00
Depth (ft bgs)	5	20	40	60	80	10	25	45	50	65	85
1,1,1-Trichloroethane											
1,1,2-Trichloroethane											
1,1-Dichloroethane						33	5	2	3		
1,1-Dichloroethene						8					
1,2-Dichloroethane											
1,2-Dichloroethene											
Acetone							12				
Carbon Disulfide						4					
Chloroethane											
Chloro form											
Ethyl benzene											
Trichlorofluoromethane											
Toluene											
Vinyl Chloride											
Xylene											

TABLE 3-3

POSITIVE DETECTIONS IN GROUNDWATER (ug/L)
SOUTHERN AREA
PHASE 2 REMEDIAL INVESTIGATION
NWIRP CALVERTON, NEW YORK
PAGE 6 OF 6

Well ID	SA-TW-112					SA-TW-113				
Sample Date	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00
Depth (ft bgs)	22	35	55	75	95	20	35	60	75	95
1,1,1-Trichloroethane								24	6	18
1,1,2-Trichloroethane										
1,1-Dichloroethane			5					120	43	130
1,1-Dichloroethene			1					12	3	9
1,2-Dichloroethane										
1,2-Dichloroethene										
Acetone										
Carbon Disulfide										
Chloroethane								5	1	5
Chloro form	3	2	2							
Ethyl benzene										
Trichlorofluoromethane										
Toluene										
Vinyl Chloride			2							
Xylene										

Notes:
Blank = Not detected at the analytical method detection limit
* = Duplicate Sample
Shaded = Detection exceeds NYSDEC Drinking Water Protection Standards
bgs = below ground surface
Concentrations in µg/L
Other VOCs not detected

TABLE 3-4

POSITIVE DETECTIONS IN PERMANENT MONITORING WELLS (ug/L)
SITE 6A - FUEL CALIBRATION AREA
PHASE 2 REMEDIAL INVESTIGATON
NWIRP CALVERTON, NEW YORK

Location	FC-MW-02-S	FC-MW-03-S	FC-MW-07-S	FC-MW-08-S
	Source	Near Downgradient	Downgradient	Downgradient
Date	JUL '00	JUL '00	NOV '97	NOV '97
Depth (ft bgs)	12	12	15	15
1,1,1-Trichloroethane	2200			
1,1-Dichloroethane	3600			
1,1-Dichloroethene	37			21
Acetone	110			
Benzene	1			
Chloroethane	720			19
Ethylbenzene	27	81		
Toluene	180	1		
TCE	6			
Xylene	570	430		
Trichloroethene				

Notes:
Blank = Not detected at the analytical method detection limit
Shaded = Detection exceeds NYS Drinking Water Protection Standards
bgs = below ground surface
Concentrations in mg/L
Location column is the direction of the well in reference to the source area plume
Other VOCs not detected

TABLE 3-5

POSITIVE DETECTIONS (ug/L)
SOUTHERN AREA
NWIRP CALVERTON, NEW YORK
PAGE 1 OF 2

Well ID	SA-PZ-101-S,I,D				SA-PZ-102-S,I,D			SA-PZ-102		
Date	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	AUG '00	AUG '00	AUG '00
Depth (ft bgs)	S-18	I-47	D-80	D-80 (DUP)	S-10	I-37	D-80	100	125	140
1,1,1-Trichloroethane		19								
1,1-Dichloroethane		220								
1,1-Dichloroethene		21								
Chloroethane		7								

TABLE 3-5

POSITIVE DETECTIONS (ug/L)
SOUTHERN AREA
NWIRP CALVERTON, NEW YORK
PAGE 2 OF 2

Well ID	SA-PZ-103-S,I,D			SA-PZ-104-S,I,D		
Date	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00	JUL '00
Depth (ft bgs)	S-29	I-40	D-80	S-9	I-35	D-80
1,1,1-Trichloroethane						
1,1-Dichloroethane						
1,1-Dichloroethene						
Chloroethane						

Notes:
Blank = Not detected at the analytical method detection limit
Shaded = Detection exceeds NYS Drinking Water Protection Standards
bgs = below ground surface
Concentrations in µg/L
Other VOCs not detected

TABLE 3-6

MONITORED NATURAL ATTENUATION GROUNDWATER ANALYTICAL RESULTS
SITES 6A AND 10B, AND SOUTHERN AREA
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
PAGE 1 OF 2

Volatile Organic Compounds (VOCs)

Well ID	FC-MW-01-S	FC-MW-02-S		FC-MW-03-S		SA-PZ-101-I	SA-PZ-104-S
Location	Upgradient	Source		Near Downgradient		Downgradient	Downgradient
Date	JUL '00	AUG '00	AUG '00 D	AUG '00	AUG '00 D	AUG '00	AUG '00
Depth	13	11.6	11.6	11.6	11.6	47	10.5
1,1,1-Trichloroethane		1900	2000		1.7	8.1	
1,1-Dichloroethane		3300	3400		2.6	170	
1,1-Dichloroethene		25	30			18	
Chloroethane						9.1	
Ethylbenzene		46	29				
Toluene		140	110				
Xylene		510	330				

TABLE 3-6

MONITORED NATURAL ATTENUATION GROUNDWATER ANALYTICAL RESULTS
SITES 6A AND 10B, AND SOUTHERN AREA
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
PAGE 2 OF 2

Natural Attenuation Parameters

Well ID	FC-MW-01-S	FC-MW-02-S	FC-MW-03-S	SA-PZ-101-I	SA-PZ-104-S
Location	Upgradient	Source	Near Downgradient	Downgradient	Downgradient
Date	JUL '00	AUG '00	AUG '00	AUG '00	AUG '00
Depth	13	11.6	11.6	47	10.5
Biochemical oxygen demand (5 day)	3.6	23		3.5	7.8
Chemical oxygen demand	15.2	84.1			28.3
Dissolved oxygen	0.94	0.39	3.51	2.34	4.37
Hydrogen Sulfide	0.1	0.5	0	0	0
Carbon dioxide	4.3			0.63	9.1
Methane	2.6	0.8	0.062	0.85	3.8
Ethane					
Ethene					
Chloride	2.2	2.3		6.3	6.8
Nitrate	0.14				
Nitrite					
Ortho phosphate					
Sulfate	4		2	14.2	3.2
Sulfide		3		1	2.2
Total organic carbon	7.8		1.3	1.3	11.3
Iron	7740	12100		753	19100
Manganese	202	50		814	622

Notes:
Blank = Not Detected
Shaded = Detection exceeds NYS Drinking Water Standards
VOC and Inorganic concentrations in µg/L, Natural Attenuation Parameter concentrations in mg/L
Location column is the direction of the monitoring well in reference to the source area plume
Other VOCs and Inorganics Not Detected

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